

ATOMIC BOMB HEALTH BENEFITS

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“The collected data strongly suggest that low-level radiation is not harmful, and is, in fact, frequently ‘apparently beneficial’ for human health.”

—*Kondo, 1993*

Media reports of deaths and devastation produced by atomic bombs convinced people around the world that all ionizing radiation is harmful. This concentrated attention on fear of minuscule doses of radiation. Soon the linear no threshold (LNT) paradigm was converted into laws. Scientifically valid information about the health benefits from low dose irradiation was ignored. Here are studies which show increased health in Japanese survivors of atomic bombs. Parameters include decreased mutation, leukemia and solid tissue cancer mortality rates, and increased average lifespan. Each study exhibits a threshold that repudiates the LNT dogma. The average threshold for acute exposures to atomic bombs is about 100 cSv. Conclusions from these studies of atomic bomb survivors are:

- One burst of low dose irradiation elicits a lifetime of improved health.
- Improved health from low dose irradiation negates the LNT paradigm.
- Effective triage should include radiation hormesis for survivor treatment.

Keywords: atomic bomb, cancer, health, lifespan, LNT, mutation

INTRODUCTION

Most people believe the LNT (linear no threshold) paradigm for radiation and its corollary: all ionizing radiation is harmful. The devastation and harm from atomic bombs in Japan dominated the media and confirmed the LNT dogma for people around the world. The LNT dogma must be true: it is in our texts; it is taught in schools and universities; it is constantly assumed in the media; and it is the law in many countries.

However, there is a fallacy. As the French philosopher, Jean de la Bruyere (1645-1696), noted: “The exact contrary of what is generally believed is often the truth.” (Bruyere, 1688). In order to make them believe the LNT dogma, radiobiologists have consistently misled students, physicians, professors, the media, the public, government advisory boards, and heads of nations. About thirty specific examples of this deception have been presented (Luckey, 2008a).

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This report reviews unpublicized studies of low dose exposures from atomic bombs in Japanese survivors. The consistent benefits from low dose exposures to radiation from atomic bombs negate the LNT paradigm and indicate a single exposure to low dose irradiation produces a lifetime of improved health.

Focus on harm from miniscule doses of ionizing radiation has blinded people to the benefits of low doses of ionizing radiation. For over a century it has been known that exposure of whole organisms to low doses of ionizing radiation consistently induces biopositive effects. These are recorded in over 3,000 reports (Luckey 1980, 1991, Muckerheide, 2002). No statistically valid scientific report was found in which low doses of ionizing radiation showed harm for genetically normal humans or laboratory animals. Thus, the LNT dogma has no scientific support from whole body exposures in humans or laboratory animals. The elite committee of the French Academies of Sciences and the National Academy of Medicine agreed: "In conclusion, this report doubts the validity of using LNT in the evaluation of the carcinogenic risk of low doses (<100 mSv) and even more for very low doses (10 mSv)." (Auringo *et al*, 2005).

Knowledge about health benefits in Japanese survivors of uranium (Hiroshima), plutonium (Nagasaki), and hydrogen (fishermen) bombs resolves the hiatus between common knowledge and scientific data. Doses were estimated from position and shielding for each person in Hiroshima and Nagasaki at the time the bombs exploded. Except for the fishermen, the major doses were direct results from the bomb explosions and do not include radiation from fallout during travel thereafter. Exposures from air and the ingestion of food and water were ignored. Note: exposures from the papers of Shimizu *et al.* (1990, 1992a, 1992b) were estimated from ranges provided for each exposed cohort. Unfortunately, some of the early papers used cGy with the assumption that a neutron was equivalent to 1 cGy; however, the estimates for Nagasaki are valid. Control populations were sometimes poorly designated. "In city" controls were taken from populations within 3 km of the epicenter of each bomb. "Not in city" controls were taken from villages more than 3 km from the bomb epicenter. This has a large margin of error; the fallout was 20 cGy in a town over a small mountain and 3 km east of Nagasaki (Kondo, 1993).

A total of 86,543 persons were in the exposed cohorts of the two cities; 45,148 received up to 1 cSv and served as "in city controls". These survivors were sometimes more healthy than outside controls. Over 90% of the exposed cohorts received less than 50 cSv.

From the depths of devastation by atomic bombs, many Japanese scientists learned to accept the complete dose-response effects of ionizing radiation as a beneficial, required agent (Luckey 2007). Dr. Hattori, a leader in radiation hormesis, noted: "If radiation hormesis exists, our

daily activities in radiation management have been extremely erroneous.” (Hattori, 1994). Japan now leads the world in using atoms for peace. This includes more than nuclear power. Japan has several low dose radiation therapy clinics.

Atomic bomb destruction in Japan has been much publicized. This bias confirmed the LNT dogma for most people. Little or no publicity was given to the biopositive effects of atomic bombs in Japanese survivors. This review shows that benefits from atomic bombs consistently produced thresholds. Each threshold negates the LNT dogma.

BENEFITS FROM ATOMIC BOMBS

Mutation

When damage from atomic bombs was first considered, our congress and the public were deeply impressed by pictures of genetic monsters in fruit flies which had received excessive doses of ionizing radiation. This started radiation hysteria, provided abundant money for research on harm from ionizing radiation, and effectively stopped support for research on the benefits of low dose irradiation (Brucer, 1990). Excess radiation did cause radiation sickness and death in Japanese victims of atomic bombs.

However, no genetic monsters were found in children from exposed parents. After half a century of study, no statistically significant effects were found in congenital defects, stillbirth, leukemia, cancer, offspring death rates, sex ratio, growth and development during childhood, chromosomal aneuploidy and translocations, or mutations. An exquisitely sensitive test was preformed for point mutations of DNA as reflected in serum proteins. No effect was found in 298,868 individual tests in children exposed to a variety of different doses of ionizing radiation from atomic bombs (Neel *et al.*, 1980, Schull *et al.* 1981).

Data from the Radiation Effects Research Foundation (RERF) in Hiroshima showed that lightly exposed fetuses had fewer phenotypic abnormalities than were found in controls (fig. 1) (Schull *et al.*, 1981). When compared with the control population, Schull and associates noted that Japanese children born from mothers exposed to low doses of ionizing radiation had fewer stillbirths, congenital effects, and neonatal deaths. The threshold (ZEP is the zero equivalent point) was about 100 cGy to the ovary. These results were obtained when exposures of the fathers was <10 cGy.

Small head size was sometimes found in babies in Hiroshima and Nagasaki (Kondo, 1993). In each city very few were found when exposures occurred after the first trimester. Severe mental retardation occurred in Nagasaki when exposures exceeded 300 cGy; in Hiroshima

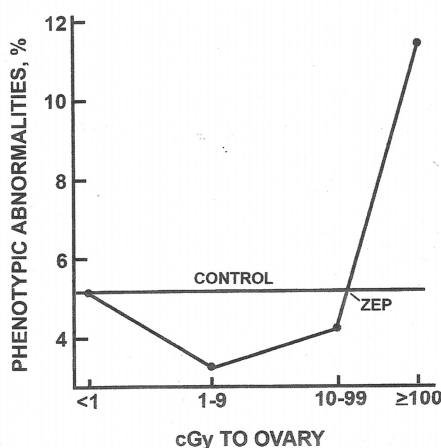


FIGURE 1. Percent of phenotypic abnormalities in 50,689 pregnancies in Hiroshima and Nagasaki when the father received <10 cGy. (Schull *et al.*, 1981)

this threshold was about 100 cGy (Kondo, 1993). The peak of this syndrome was in babies who had been exposed 8-15 weeks after fertilization.

Studies on reproduction in Japanese survivors of atomic bombs consistently revealed that exposures to acute, low dose irradiation were beneficial. “In particular, the studies should provide reassurance to that considerable group of exposed Japanese and their children, without whose magnificent cooperation these studies would have been impossible and who have over the years been subjected to a barrage of exaggerations concerning the genetic risks involved.” (Neel *et al.*, 1990).

The work with humans verified previous results of research with animals. When chronically exposed to low dose irradiation, laboratory animals showed benefits in all phases of reproduction (Luckey, 1991). This included fertility, sterility, mutation, embryo and neonatal viability, and the physical development of infants.

Cancer

It has been hypothesized that cancer would become negligible if low doses of chronic irradiation were adequate (Luckey, 2008b). This appears to be true for leukemia following acute, low dose irradiation. Leukemia is considered to be the most radiation inducible of all cancers.

The BEIR I committee reported zero leukemia deaths (Fig. 2a) for 2,527 Nagasaki survivors of the plutonium bomb; these were placed in cohorts which had received 31 and 69 cGy (BEIR I, 1972). The threshold was about 80 cGy. This zero leukemia incidence was confirmed by Land (1980) who noted that persons (25,643 person-years) exposed to 39 cGy had no leukemia (Fig. 2b). The threshold was about 50 cGy. When leukemia mortality rates for all atomic bomb survivors were considered

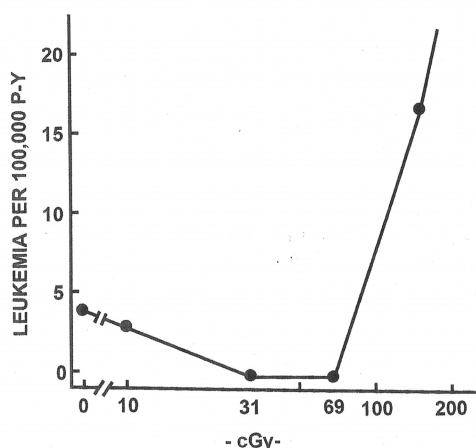


FIGURE 2. a. Leukemia mortality rates per 100,000 person-years in Nagasaki survivors of the plutonium bomb (BEIR I, 1972).

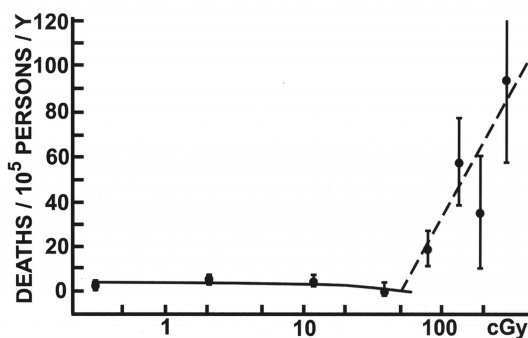


FIGURE 2. b. Leukemia mortality rates (deaths per 100,000 persons per year) in Nagasaki (Land, 1980).

(Fig. 2c), there was a minimum in those exposed to 7.2 cGy (Shimizu *et al.*, 1990). The threshold was 14 cGy. It is important to note that the “controls” in this study were persons not in the cities. The exposed control group (exposed to <1 cGy) had lower leukemia mortality rates than the cohort outside the two cities. The cumulative leukemia mortality rates for all survivors (Fig. 2d) showed a threshold at about 26 cGy (Shimizu *et al.*, 1992a).

When compared with not-in-city controls, the non leukemia cancer and total cancer mortality rates (Fig. 3a) showed comparable minima at 7cGy (Kato *et al.*, 1987). The data were taken from 1950 to 1978. The threshold for each was also the same, 12 cGy. If one assumes the RBE for neutrons is 10 (not 1 as used by the authors), the threshold would be about 120 cGy.

Data from non-leukemia cancer mortality rates for both cities (Fig. 3b) indicated there were decreased solid cancer deaths when exposures

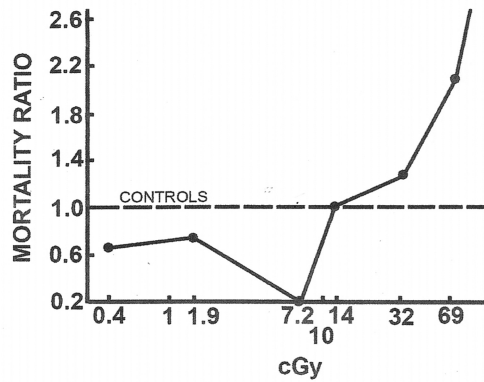


FIGURE 2. c. Leukemia mortality rates in Hiroshima and Nagasaki (Shimizu *et al.*, 1990).

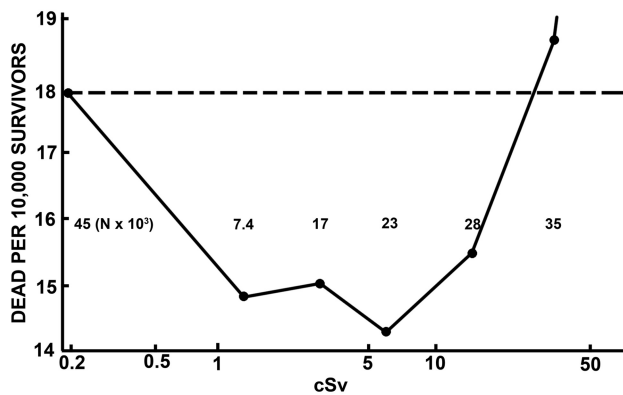


FIGURE 2. d. Cumulative leukemia mortality rates in Japanese survivors of atomic bombs (Shimizu *et al.*, 1992).

were less than 2 cGy (Shimizu *et al.*, 1990). Since exposures up to 32 cGy were not statistically different from the controls, the practical threshold appeared to be about 25 cGy.

The total cancer mortality rates in Nagasaki survivors (Fig. 4a) did not exceed the control value up to 300 cGy (Mettler and Moseley, 1985). It appears that radiation (mostly neutrons) from the plutonium bomb was weakly carcinogenic. The threshold was about 340 cGy. Note, the “in city” population (the open circle represents survivors who received about 0.03 cGy) had a slightly lower rate (2.2 deaths per 1,000 persons) than that of the control (general) population.

When “observed” were compared with “expected” cancer mortality rates in both cities (Fig. 4b), the threshold appeared to be about 20 cGy (Shimizu *et al.*, 1990). The total cancer mortality (MM) was significantly decreased ($p < 0.01$ with the χ^2 test) in the 7,400 persons exposed to about 2 cSv (Fig 4c) Shimizu *et al.*, 1992a). The threshold was about 3 cSv. As would be expected, the cancer mortality rates in most specific organs of the Japanese survivors showed hormesis (Kondo, 1993).

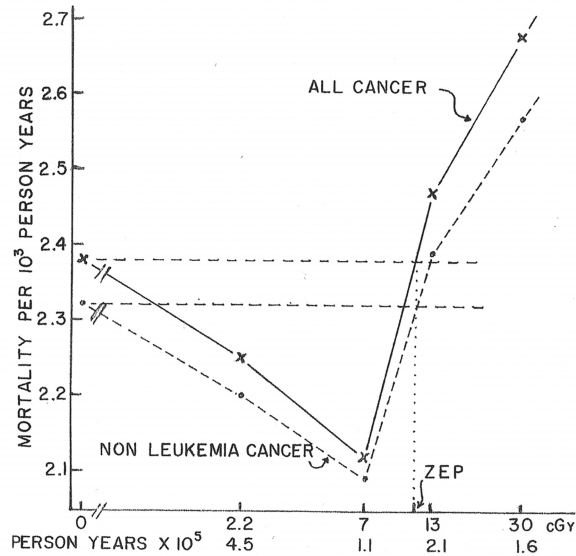


FIGURE 3. a. The simple average cancer mortality rates in both cities (1950-1978) with and without including leukemia (Kato *et al.*, 1987). The units at the bottom indicate the size of each group per 100,000. The assumed relative biologic effectiveness (RBE) of neutrons was one.

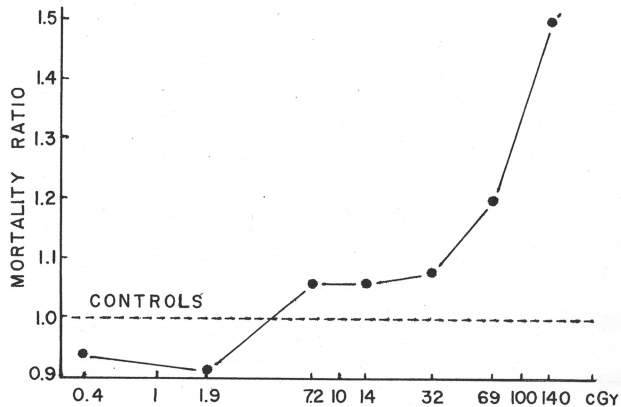


FIGURE 3. b. Non-leukemia cancer mortality rates in both cities (Shimizu *et al.*, 1990). The ordinate provides the relative risk of cancer mortality when compared with that of the control population.

The cumulative total cancer mortality rate of 7,400 persons in both cities (Fig. 4d) was significantly ($p < 0.01$) less than that of the “in city” controls (>3 km from the epicenter) (Shimizu *et al.*, 1992b). The threshold as graphed was about 3 cSv. The apparent threshold (a straight line from the second to include the last three points) was 6 cSv; this would include 23,000 exposed persons who had a lower cancer mortality rate than the controls.

The data consistently indicate reduced leukemia and solid tissue cancer mortality rates. These contributed to an increased average lifespan.

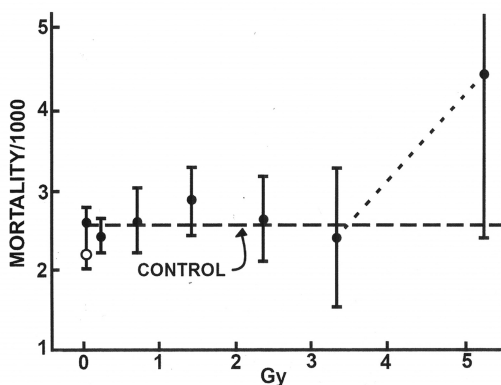


FIGURE 4. a. Total cancer mortality rates per 1,000 atomic bomb survivors in Nagasaki (Mettler *et al.* 1985). Age adjusted rates were used. One standard error is displayed.

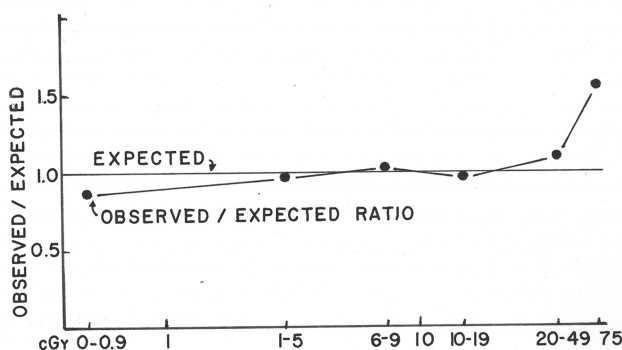


FIGURE 4. b. Comparison of expected with observed total cancer mortality rates of atomic bomb survivors in the two cities (Shimizu *et al.*, 1990).

Lifespan

Abundant evidence from laboratory animals presented the concept that the biopositive effects of low dose irradiation included increased average lifespan (Luckey, 1991). In a survey of 50,689 children born of parents exposed to atomic bombs, those whose mother received 10-99 cGy (gonad dose) had lower mortality rates than the controls (Schull *et al.*, 1981). This advantage held for children whose father received 0, 10-99, or >100 cGy.

When compared with age matched controls, the non-cancer mortality rates for survivors in Nagasaki exposed to 50-99 cGy was only 65% that of controls (Fig. 5a) (Kondo, 1993). This was a significant decrease ($p < 0.05$). The threshold was about 180 cGy. The relative risks for non-cancer mortality rates in both cities (Fig. 5b) showed no decreased average lifespan in 20,000 persons exposed to less than 200 cSv (Shimizu *et al.*, 1992b) The threshold was 155 cSv. The RERF presentation of the same data base

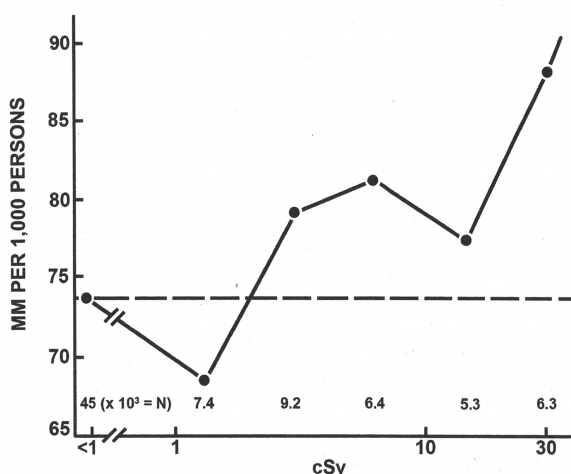


FIGURE 4. c. Total cancer mortality rates (MM) in both cities (Shimizu *et al.*, 1992). Thousands of persons for each point is noted above the abscissa.

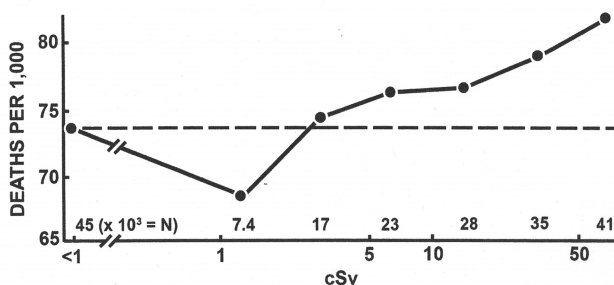


FIGURE 4. d. Cumulative total cancer mortality rates of 41,000 exposed atomic bomb survivors in both cities (Shimizu *et al.*, 1992). The thousands of persons for each point is noted above the abscissa.

(Shimizu, 1992a, p. 72) showed a marked decrease in non-cancer mortality rates with increased exposures (Fig. 5c). These data include deaths from 1950 to 1985. The threshold appears to be greater than 50 cGy.

The total mortality rates in both cities (Fig. 6) showed a decreased relative risk ($p < 0.01$) for persons exposed to less than 14 cGy (Mine *et al.*, 1990). The threshold was about 70 cGy. The relative risk at 300 cGy (not graphed) was only 1.3. Although these data are essentially those released by the RERF (Fig. 5b), the interpretation is different (Shimizu *et al.* 1992b).

The increased average lifespan of lightly exposed Japanese survivors of atomic bombs might be attributed to increased medical care and/or radiation hormesis. Data from Nagasaki provided correction for the special medical care of survivors, the “healthy survivor effect” (Kondo, 1993). Figure 7 provides a comparison of the annual mortality rates of lightly exposed with more heavily exposed persons. The controls were survivors who 1) were in the city; 2) were exposed to <0.5 cGy; 3) carried

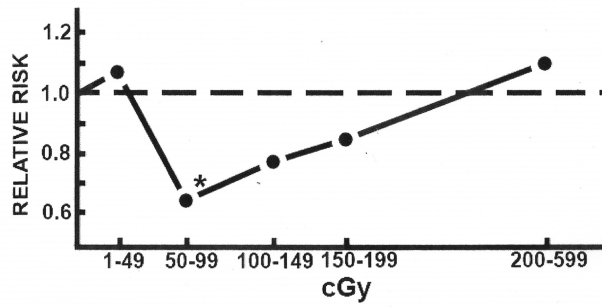


FIGURE 5. a. Mortality rates for non-cancer deaths of atomic bomb survivors in Nagasaki (Kondo, 1993).

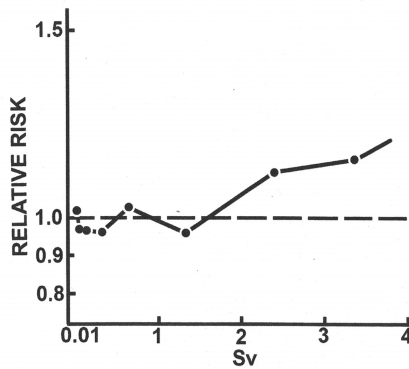


FIGURE 5. b. Relative risks for non-cancer deaths in both cities (Shimizu *et al.*, 1992).

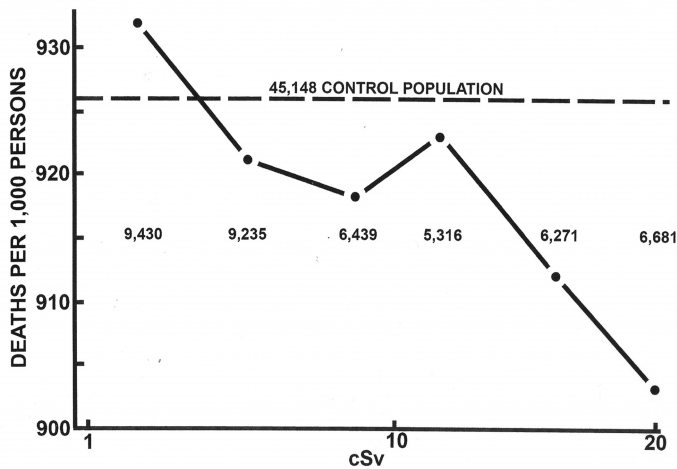


FIGURE 5. c. Total non-cancer mortality rates in both cities (Shimizu *et al.*, 1992).

a “health handbook”; and 4) received the same medical care and other benefits as the more heavily exposed persons. This indicates the major beneficial effects were due to low dose irradiation from atomic bombs.

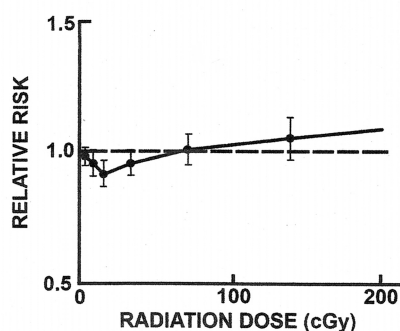


FIGURE 6. Relative risks for total mortality in both cities (Mine *et al.*, 1990).

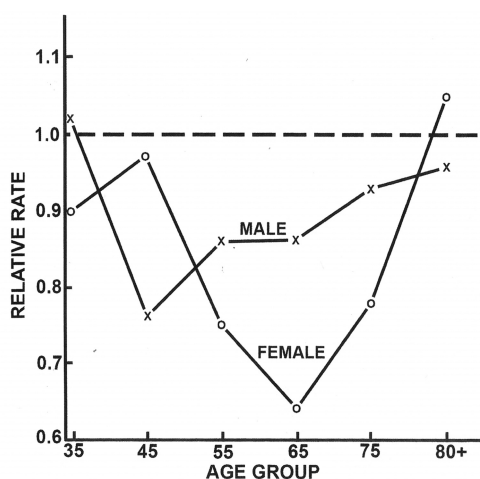


FIGURE 7. Relative risks for total mortality in Nagasaki survivors. Those exposed to >1 cGy were compared with those who were exposed to <0.5 cGy. Each age group represents a ten year span, ± 5 years of the year displayed (Kondo, 1993).

Hydrogen Bomb Fallout

In March, 1954, fallout of a hydrogen bomb test at Bikini Island covered 23 young Japanese fishermen. They were 23 miles downwind from the epicenter. Everything was covered with white powder. After two weeks at sea, they received good medical care. All had radiation sickness. None died from cancer for at least 40 years (Kondo, 1993). Kondo estimated that one received 670 cGy. He died at 206 days with anemia, hepatitis, and leucopenia. The others received 200-575 cGy. One died 21 years later with liver cirrhosis. The rest recovered. An estimated threshold for this group is 60 cGy.

The results from the young Japanese fishermen is comparable with those of 209 workers (not counting the 23 who died soon following the explosion) at Chernobyl who were hospitalized with radiation sickness

from mostly low LET (linear energy transfer) radiation. None died who received <200 cGy (Metivier, 1995).

DISCUSSION

The evidence presented indicates that acute, low dose irradiation induced lifetime health benefits for Japanese survivors of atomic bombs. Each graph exhibited radiation hormesis and a threshold. The flash exposure for those in Hiroshima and Nagasaki was equivalent to a radiation vaccination. That suggests an important concept. These data indicate that acute exposure to low dose irradiation is adequate, with or without chronic exposures, to provide lifetime health benefits. Previous attention involved human exposures to chronic radiation. The question of hormesis and thresholds following chronic versus acute exposures needs resolution.

Animal research has shown that both chronic and acute exposures elicited long-term effects (Luckey, 1991). These effects include: 1) resistance to large doses of ionizing radiation, 2) faster wound healing, 3) improved DNA and cell repair, 4) enhanced immunity, both cellular and chemical vectors, 5) decreased morbidity (particularly from infections), 6) healthier offspring, 7) decreased mortality rates, and 8) longer average lives.

This summation of the health benefits from atomic bombs supports the information regarding the essential nature of ionizing radiation and the probability that we live in a partial deficiency of this essential agent (Luckey, 1997, 1999). Radioactive waste is a readily available source for increased irradiation for health (Luckey, 2008b). Radioactive waste was a major problem in the 20th century. The redistribution of radioactive waste is a solution for better health in the 21st century.

Misinformation about harm from atomic bombs solidified popular beliefs in the LNT dogma. In contrast to that belief, this new knowledge about health benefits from atomic bombs should initiate trust in, and application of, low dose irradiation. Each study of Japanese survivors of atomic bombs revealed a threshold which separated biopositive from bionegative effects. Each threshold negates the LNT dogma. The data presented confirm the conclusion of the elite French committee: "However, the use of LNT in the low dose or dose range is not consistent with radiobiological knowledge." (Aurengo *et al.*, 2005). The concept that all radiation is harmful is false.

Quantitative thresholds for acute exposure to ionizing radiation were noted for each graph. A summation provides a rough index of safety from acute exposures to ionizing radiation. The low linear energy transfer (LET) exposures in Nagasaki were due primarily to gamma rays with few fast neutrons from the plutonium bomb. The average threshold from Nagasaki (Figs. 2a, 2b, 4a and 5a) was 160 cGy. Useful quantification involving the uranium bomb at Hiroshima must await clarification from RERF in their use of cGy for high LET radiation. "Almost all the health

effects of radiation observed among atom bomb survivors were more severe in people exposed in Hiroshima than in those in Nagasaki.” (Kondo, 1993). Kondo suggested the difference was due to the abundance of neutrons from the uranium bomb. The average threshold for 10 studies involving Hiroshima was 47 cSv.

The consistency of increased health in Japanese survivors who received low doses of radiation indicates a new category for radiation triage. Psychological and physical traumas are, of course, separate matters. Survivors who received doses less than the threshold need no special care for irradiation damage. They could help the health team.

CONCLUSIONS

Understanding the concerted effect of acute, low dose irradiation in Japanese survivors of atomic bombs allows three conclusions.

- A threshold for health following acute irradiation is well documented.
- One burst of ionizing radiation elicits a lifetime of increased health.
- A new concept of triage should include radiation hormesis.

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